CHROMOSOME NUMBERS OF FLOWERING PLANTS IN THE NETHERLANDS

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ABSTRACT

154 plant species, chosen at random, and collected in the Netherlands were investigated cytologically. The chromosome numbers determined were compared with data known from other countries.

INTRODUCTION

Up to now different lists and atlasses with chromosome numbers of plants were published, mostly concerning distinct areas as: The Alps, (FAVAGER, 1949, 1953, 1959); Central- and Northwest Europe (LÖVE and LÖVE, 1961); England, (MAUDE, 1939, 1940); Greenland, (JÖRGENSEN, SÖRENSEN and WESTERGAARD, 1958); Hungary, (POLYA, 1949; BAKSAY, 1956); Iceland, (LÖVE and LÖVE, 1956); Poland, (SKALINSKA, 1950; SKALINSKA, *et al.*, 1957, 1959); Romania, (TARNAVSCHI, 1948); Scandinavia, (LÖVE and LÖVE, 1942[b]); Schleswick-Holstein, (WULFF, 1937[b+c], 1938, 1939, 1950).

The flora of the Netherlands has scarcely been investigated cytologically up to the present. Detailed cytological investigations have been done only on some genera. For lack of data chromosome numbers could not be listed before.

Cytogeographic investigations of different plant species have greatly contributed to a better understanding of the taxa concerned. So it seemed appropriate to initiate cytological research in the flora of the Netherlands. Therefore, in 1958, investigations were started for the preparation of a list of chromosome numbers. Plants of 154 species, chosen at random, all collected in the Netherlands, are treated in this article. It is the intention to extend this list in the future.

MATERIAL AND METHODS

Chromosome counts were made on metaphase plates of roottip cells. For this purpose roottips were fixed in Karpechenko. Fixations were made in the field directly, except for the genera *Campanula*, *Galium* and *Viola*, which were reared in pots in the open. The roottips were embedded in paraffin, sectioned at 15 micron and stained according to Heidenhain's haematoxylin method. Voucher specimens of all the investigated material have been deposited in the Botanical Museum and Herbarium, Utrecht.

RESULTS

The results of the countings are given in the following tables:

Table 1. Species with chromosome numbers in accordance with the literature.

Table 2. Species with intraspecific cytological variation.

Table 3. Species with chromosome numbers not determined before.

Table 1. Chromosome numbers in accordance with the literature. In the first column the voucher number is listed, in the second the name of the species, in the third the somatic chromosome number, and in the fourth the origin of the material concerned.

Table 2. Species with intraspecific cytological variation. To the left the same grouping as in table one, to the right a survey of the cytological investigations up to the present. (In the first column the author and year of publication, in the second the origin and the chromosome number.)

Table 3. Species with chromosome numbers not determined before. Grouping of the table, the same as in table one.

TABLE I

Species with chromosome numbers in accordance with the literature.

Herbarium number	Species	2n	Origin
600	Adoxa moschatellina L.	36	Schone Grub near Rijckholt (Limburg)
597	Allium ursinum L.	14	Schone Grub near Rijckholt (Limburg)
561	Alopecurus pratensis L.	28	Fort Hoofddijk near Utrecht (Utrecht)
736	Anagallis arvensis L.	40	Fort Hoofddijk near Utrecht (Utrecht)
609	Anthoxanthum odoratum L.	20	Cotessen near Epen (Limburg)
183	Armeria maritima (Mill.) Willd.	18	de Waal, Texel (N. Holland)
727	,, ,,	18	Gaasterland, Laaxum (Friesland)
551	Arum maculatum L.	56	St. Jansberg near Mook (Limburg)
640	Ballota nigra L.	22	near Bemelen (Limburg)
689	,, ,,	22	Grebbeberg, Rhenen (Utrecht)
562	Bellis perennis L.	18	Fort Hoofddijk near Utrecht (Utrecht)
C43	Campanula rapunculoides L.	102	Wrakelberg, Wijlré (Limburg)
C404–C407	,, ,,	102	Oost-Voorne (S. Holland)
C674	,, ,,	102	Schweiberger Bos near Mechelen (Limburg)
C44	,, trachelium L.	34	Savelsbos, Grondsveld (Limburg)
C416	,, ,,	34	Gerendal, Schin op Geul (Limburg)
346	Cardamine flexuosa With.	32	Molenpolder, Westbroek (Utrecht)
673	,, ,,	32	Terziet (Limburg)
670	Chrysosplenium oppositifolium L.	42	Belletbeek, Epen (Limburg)
718	Cirsium arvense (L.) Scop.	34	Between Jutphaas & IJsselstein (Utrecht)
738	,, palustre (L.) Scop.	34	Betw. Ermelo & Nieuw Millingen (Gelderl.)
658	Clematis vitalba L.	16	Dolsberg, Wijlré (Limburg)
0 89	Coeloglossum viride (L.) Hartm.	40	Bemelen (Limburg)
589	Dactylis glomerata L.	28	Rhijnauwen near Utrecht (Utrecht)
750	Drosera intermedia Hayne	20	Betw. Ermelo & Nieuw Millingen (Gelderl.)
0 120	Epipactis palustris (L.) Crantz	40	near Veenendaal (Gelderl.)
0 129	,, ,,	40	id.
0 117	,, ,,	40	id.
0 122	,, ,,	40	id.
629	Eupatorium cannabinum L.	20	near Gulpen (Limburg)
706	,, ,,	20	Quackjeswater, Rockanje (S. Holland)
703	Euphorbia peplus L.	16	In a garden, Utrecht (Utrecht)
701	Fraxinus excelsior L.	46	id.
K 63	Galium cruciata (L.) Scop.	22	Heimansgroeve, Epen (Limburg)
K 68	,, ,,	22	Schweiberger Bos near Mechelen (Limburg)
K 18	,, mollugo L.	44	Betw. Egmond a.d. Hoef & Egmond Binnen (N. Holland)
K 58	,, ,,	44	Bovenste Bos, Epen (Limburg)

TABLE I (Cont.)

Herbarium number	Species	2n	Origin
K 133	Galium mollugo L.	44	Weerdinge (Drenthe)
K 134	,, ,,	44	id.
K 135	,, ,,	44	id.
K 142	,, ,,	44	Johannapolder near Utrecht (Utrecht)
K 143	,, ,,	44	id.
K 161	,, ,,	44	Between Epen & Mechelen (Limburg)
K 622	,, ,,	44	near Schalkwijk (Utrecht)
K 69	,, sylvaticum L.	22	St. Jansberg near Mook (Limburg)
K 70	,, ,,	22	id.
K 71	,, ,,	22	id.
K 72	,, ,,	22	id.
K 112	,, ,,	22	id.
K 15	,, verum L.	44	Between Bakkum & Egmond (N. Holland)
K 16	,, ,,	44	id.
K 40	,, ,,	44	Kunrader Berg near Voerendaal (Limburg)
K 41	,, ,,	44	id.
K 42	,, ,,	44	id.
K 43	,, ,,	44	id.
K 46	,, ,,	44	id.
K 48	,, ,,	44	id.
K 50	,, ,,	44	id.
K 84	,, ,,	44	W. Kapelle (Zeeland)
K 249	,, ,,	44	Oude Mirdum (Friesland)
696	Galeopsis tetrahit L.	32	Grebbeberg, Rhenen (Utrecht)
590	Glyceria fluitans (L.) R.Br.	40	Rhijnauwen near Utrecht (Utrecht)
719	,, maxima (Hartm.) Holmb.	60	near IJsselstein (Utrecht)
0 174	Goodyera repens (L.) R.Br.	40	Schoorl (N. Holland)
0 63	Gymnadenia conopsea (L.) R.Br.	40	Kunrader Berg near Voerendaal (Limburg)
0 104	,, ,,	40	Meeuwenkamp near Ede (Gelderl.)
654	Hedera helix L.	48	Dolsberg, Wijlré (Limburg)
663	Helictotrichon pubescens (Huds.) Pilger	14	Gerendal, Schin op Geul (Limburg)
0 281	Herminium monorchis (L.) R.Br.	40	Schiermonnikoog (Friesland)
563	Lamium album L.	18	Fort Hoofddijk near Utrecht (Utrecht)
657	,, maculatum L.	18	Between Eys & Gulpen (Limburg)
801	Lotus uliginosus Schkuhr	12	Betw. Ermelo & Nieuw Millingen (Gelderl.)
545	Luzula maxima DC	12	St. Jansberg, Mook (Limburg)
555	Lycopus europaeus L.	22	id.
661	Melica uniflora Retz.	18	Gerendal, Schin op Geul (Limburg)
342	Mentha aquatica L.	96	Molenpolder, Westbroek (Utrecht)
639	,, rotundifolia (L.) Huds.	24	Bemelerberg, Bemelen (Limburg)
605	Mercurialis annua L.	16	near Rijckholt (Limburg)
634	,, ,,	16	Kadier en Keer (Limburg)
552	Milium effusum L.	28	St. Jansberg, Mook (Limburg)
334	Myosotis scorpioides L.	64	Molenpolder, Westbroek (Utrecht)
348	,, ,,	64	Molenpolder, Westbroek (Utrecht)
723	,, ,,	64	near Jutphaas (Utrecht)
747	Narthecium ossifragum (L.) Huds.	26	Betw. Ermelo & Nieuw Millingen (Gelderl.)
0 259	Ophrys apifera Huds.	36	Wrakelberg, Wijlré (Limburg)
—	Orchis mascula (L.) L.	42	Bovenste Bos, Epen (Limburg)
0 55	,, militaris L.	42	Savelsbos, Grondsveld (Limburg)
—	,, morio L.	36	Rozenkoele, Kadier en Keer (Limburg)
—	,, purpurea Huds.	42	Geerendal, Schin op Geul (Limburg)
—	,, ,,	42	Schweiberger Bos near Mechelen (Limburg)
546	Oxalis acetosella L.	22	St. Jansberg near Mook (Limburg)
608	,, ,,	22	Bovenste Bos, Epen (Limburg)
603	Paris quadrifolia L.	20	Schone Grub, Rijckholt (Limburg)

TABLE I (Cont.)

Herbarium number	Species	2n	Origin
702	Plantago major L.	12	In a garden, Utrecht (Utrecht)
0 231	Platanthera bifolia (L.) Rich.	42	Terschelling (Friesland)
0 77	„ chlorantha (Cust.) Rchb.	42	Bovenste Bos, Epen (Limburg)
0 76	„ „	42	Bovenste Bos, Epen (Limburg)
251	Poa annua L.	28	near Oost-Voorne (S. Holland)
746	Potentilla erecta (L.) Räuschel	28	Betw. Ermelo & Nieuw Millingen (Gelderl.)
699	„ reptans L.	28	Grebbeberg, Rhenen (Utrecht)
712	Ranunculus flammula L.	32	Quackjeswater, Rockanje (S. Holland)
742	„ „	32	Betw. Ermelo & Nieuw Millingen (Gelderl.)
655	Sanicula europaea L.	16	Eyserbos, Eys (Limburg)
369	Scrophularia nodosa L.	36	Schweiberger Bos near Mechelen (Limburg)
538	„ „	36	St. Jansberg, Mook (Limburg)
593	„ „	36	Mereveld near Utrecht (Utrecht)
611	„ „	36	Onderste Bos, Epen (Limburg)
730	„ „	36	Fort Hoofddijk near Utrecht (Utrecht)
618	Senecio fuchsii Gmel.	40	Onderste Bos, Epen (Limburg)
694	„ vulgaris L.	40	Grebbeberg, Rhenen (Utrecht)
717	Sonchus arvensis L.	54	Oost-Voorne (S. Holland)
357	Stachys silvatica L.	66	Schweiberger Bos near Mechelen (Limburg)
553	„ „	66	St. Jansberg, Mook (Limburg)
624	„ „	66	Onderste Bos, Epen (Limburg)
606	Stellaria holostea L.	26	Schone Grub, Rijckholt (Limburg)
716	Suaeda maritima (L.) Dum.	36	near Oost-Voorne (S. Holland)
688	Tanacetum vulgare L.	18	Grebbeberg, Rhenen (Utrecht)
340	Thalictrum flavum L.	84	Molenpolder, Westbroek (Utrecht)
617	Thymus pulegioides L.	28	Kuttingen near Epen (Limburg)
K 101	Trifolium arvense L.	14	West Kapelle (Zeeland)
K 99	„ campestre Schreb.	14	id.
K 95	„ striatum L.	14	id.
739	Typha angustifolia L.	30	Betw. Ermelo & Nieuw Millingen (Gelderl.)
341	Valeriana dioica L.	16	Molenpolder, Westbroek (Utrecht)
615	Veronica beccabunga L.	18	Terziet near Epen (Limburg)
557	„ chamaedrys L.	32	Fort Hoofddijk near Utrecht (Utrecht)
625	„ „	32	Onderste Bos, Epen (Limburg)
604	„ montana L.	18	Schone Grub, Rijckholt (Limburg)
737	„ scutellata L.	18	Betw. Ermelo & Nieuw Millingen (Gelderl.)
635	Vicia sepium L.	14	Bemelerberg, Bemelen (Limburg)
176	Viola arvensis Murr.	34	near Emmen (Drenthe)
93	„ „	34	near Ommen (Overijssel)
133	„ „	34	near Denekamp (Overijssel)
114	„ „	34	Grebbeberg, Rhenen (Utrecht)
216	„ „	34	near Hilversum (N. Holland)
102	„ „	34	near Oisterwijk (N. Brabant)
186	„ „	34	near Valkenswaard (N. Brabant)
105	„ „	34	Betw. 's-Hertogenbosch & Rosmalen (N. B.)
—	„ canina L.	40:17	different localities in the Netherlands (see Gadella, 1963)
54	„ hirta L.	20	Eyserbos, Eys (Limburg)
282	„ „	20	id.
286	„ „	20	id.
290	„ „	20	id.
9	„ „	20	Between Bakkum & Egmond (N. Holland)
52	„ „	20	near Rockanje (S. Holland)
151	„ „	20	id.
156	„ „	20	near Oost-Voorne (S. Holland)
52	„ odorata L.	20	near Rockanje (S. Holland)

TABLE I (Cont.)

Herbarium number	Species	2n	Origin
103	Viola odorata L.	20	near Oisterwijk (N. Brabant)
33	" "	20	near Epen (Limburg)
159	" "	20	Geerendal, Schin op Geul (Limburg)
162	" "	20	id.
4	" reichenbachiana Jord. ex Bor.	20	Austieberg, Denekamp (Overijssel)
5	" "	20	Lohmanskamp, Ootmarsum (Overijssel)
58	" "	20	id.
63	" "	20	id.
37	" "	20	Onderste Bos, Epen (Limburg)
191–196	" "	20	Osebos, Gulpen (Limburg)
197	" "	20	Savelsbos, Rijckholt (Limburg)
199–200	" "	20	Eyserbos, Eys (Limburg)
355	" "	20	Schweiberger Bos, Mechelen (Limburg)
388	" "	20	id.
392–397	" "	20	id.
205	" rupestris F. W. Schmidt	20	near Bergen aan Zee (N. Holland)
293	" "	20	near Oost-Voorne (S. Holland)
67, 71	" tricolor L. subsp. curtisii (Forst.)Syme	26	near Bergen aan Zee (N. Holland)
10	" " "	26	near Egmond a. d. Hoef (N. Holland)
48	" " "	26	near Rockanje (S. Holland)
43	" " "	26	near Oost-Voorne (S. Holland)
128	" " "	26	near Ouddorp (S. Holland)
172	" " subsp. tricolor	26	Oude Mirdum, Gaasterland (Friesland)
177	" " "	26	Betw. Marienberg & Ommen (Overijssel)
92, 99	" " "	26	near Ommen (Overijssel)
116	" " "	26	Betw. Holl. Rading & Hilversum (Utrecht)

TABLE II
Species with intraspecific cytological variation

Species	Coll. no.	Origin	2n
Actaea spicata L.	659	Dolsberg near Wylré (Limburg)	16
Aethusa cynapium L.	700	Utrecht, in a garden (Utrecht)	20
Alisma plantago-aquatica L.	337	Molenpolder near Westbroek (Utrecht)	14
Alliaria petiolata (Bieb.) Cavara et Grande	360	Between Wittem and Gulpen (Limburg)	36
	541	St. Jansberg near Mook (Limburg)	36
Artemisia vulgaris L.	525	Between Houten and Schalkwijk (Utrecht)	16
	636	Bemelerberg near Bemelen (Limburg)	16
	687	Grebbeberg near Rhenen (Utrecht)	16
Butomus umbellatus L.	668	Between Baarn and Eemdijk (Utrecht)	39
Campanula rotundifolia L. (s.l.)	C 39	near Maarn (Utrecht)	68

TABLE II (Cont.)

REFERENCES

Author	Origin	2n
Langlet (1927)	unknown	16
Polya (1950)	Hungary	16
Rodriguez (1949)	U.S.A.	16
Skalinska (in Skalinska et al., 1959)	Poland	16
Mattick (in Tischler, 1950)	Austria	ca. 32
Häkansson (1953)	Sweden	20
Wanscher (1931, 1932)	unknown	20
Schulz-Gaebel (1930)	Germany	22
Wewetzer (1956)	cult. mat.	10
Wulff (1939)	Germany	10
Blomstrand (in Löve and Löve, 1944)	Sweden	12
Löve and Löve (1942)	Sweden	12
Palmgren (1943)	Sweden	12
Tarnavschi (1948)	Romania	12
Björquist (1959); Löve and Löve (1942); Erlandsson (1946)	Sweden	14
de Castro and Noronha-Wagner (1950)	Portugal	14
Erlandsson (1946)	Denmark, Finland	14
Tschermak-Woess (1948)	Denmark	14
Hendricks (1957)	cult. mat.	14
Holzer (1952)	Austria	14
Pogan (1961)	Poland	14
Polya (1949)	Hungary	14
Heppell (in Maude, 1939)	England	14
Priestly (1953)	England	14
Wulff (1950)	Germany	14, 16
Baez Major (1934)	acc. to L. and L., 1961	36
Winge (1932)	unknown	ca. 36–40
Jaretski (1932)	unknown	ca. 42
Polya (1949)	Hungary	42
Clausen, Keck, Hiesey (1939, 1940)	Sweden	16
Keck (1946)	North America	16
Löve and Löve (1956)	Iceland	16
Mulligan (1957)	Canada	16
Polya (1949)	Hungary	16
Wulff (1950); Khoshoo and Sobti (1958)	Germany	16
Khoshoo and Sobti (1958)	India	36, 54
Harada (1948)	unknown	26
Harada (1956)	Japan	26
Lohammar (in Löve and Löve, 1948)	Scandinavia	26
Löve and Löve (1961)	Sweden, Canada	26
Rao (1953)	India	26
Skalinska (in Skalinska et al., 1961)	Poland	26
Whitaker (1934)	cult. mat.	26
Lohammar (1931)	Sweden	28
Lohammar (in Löve and Löve, 1948)	Scandinavia	39
Lohammar (1931); Terby (1922)	Belgium	40
Lohammar (1931)	Germany, Sweden	40
Böcher (1936, 1960)	Greenland	34

TABLE II (Cont.)

Species	Coll. no.	Origin	2n
Campanula rotundifolia L. (s.l.)	C 40	near Valkenswaard (N. Brabant)	68
	C 71	near Vledder (Drenthe)	68
	C 72	Oude Mirdum, Gaasterland (Friesland)	68
	C 73	Oude Mirdum, Gaasterland (Friesland)	68
	C 380	Betw. Denekamp and Singraven (Overijss.)	68
	C 422	near Marienberg (Overijssel)	68
	C 423	Hoge Veluwe near Otterlo (Gelderl.)	68
	C 424	Hoge Veluwe near Otterlo (Gelderl.)	68
	C 425	Hoge Veluwe near Otterlo (Gelderl.)	68
	C 677	St. Jansberg near Mook (Limburg)	68
	C 685	Emmen (Drenthe)	68
Cardamine amara L.	358	Between Gulpen and Slenaken (Limburg)	16
	315	Lage Kavik naar de Lutte (Overijssel)	16
	427	near Drimmelen (N. Brabant)	16
	819	Biesbos (N. Brabant)	16
Chrysanthemum leucanthemum L. (s.l.)	627	Between Gulpen and Mechelen (Limburg)	36
Comarum palustre L.	333	Molenpolder near Westbroek (Utrecht)	42
	743	Betw. Ermelo and Nw. Millingen (Gelderl.)	42
	816	Terschelling (Friesland)	42
Echinodorus ranunculoides (L.) Engelm. ex Aschers.	814	Hoornse Bos, Terschelling (Friesland)	14

REFERENCES

Author	Origin	2n
Böcher (1960)	France, Sweden, Denmark, U.S.S.R.	34
Böcher and Larsen (1950)	Greenland	34
Gadella (1962)	Germany, Sweden, Austria	34
Böcher (1936, 1938)	Greenland	68
Böcher (1960); Guinochet (1942); Gadella (1962)	France	68
Böcher (1938, 1960); Böcher and Larsen (1950)	Norway	68
Böcher (1936, 1960); Gadella (1962)	Denmark	68
Böcher (1960); Gadella (1962)	England, the Netherlands U.S.S.R., Germany, Sweden	68
Böcher (1960)	Eire, Norway, Finland, Faroes, Yugoslavia	68
Gadella (1962)	Czechoslovakia, Italy, Scotland	68
Böcher and Larsen (1950); Löve and Löve (1956)	Iceland	68
Hubac (1961); Gadella (1962)	France	102
Gadella (1962)	Czecho-Slovakia	102
Banach (in Skalinska, 1950)	Poland	16
Lövkvist (1956, 1957)	Sweden	16
Lövkvist (1957)	Denmark, Ireland, France	16
Manton (1932)	England	16
Lawrence (1932)	England	32
Lövkvist (1957); Mattick (in Tischler, 1950)	Austria	32
Baksay (1956, 1957); Polya (1950)	Hungary	18
Böcher and Larsen (1957)	Poland, Denmark, England	18
Cooper and Mahony (1935)	North America	18
Czapick (in Skal. et al., 1961)	Poland	18
Dowrick (1952)	cult. mat.	18
Ducker and Favarger (1956, 1957); Favarger (1959)	Switzerland	18
Martin and Smith (1955)	U.S.A.	18
Böcher and Larsen (1957)	Sweden, Yugoslavia, Denmark, France, U.S.S.R., Poland	36
Czapick (in Skalinska et al., 1961)	Poland	36
Favarger (1959)	Switzerland	36
Löve and Löve (1956)	Iceland	36
Mulligan (1958, 1959)	Canada	36
Mulligan (1958)	France, U.S.S.R.	36
Polya (1950)	Hungary	36
Rohweder (1937)	Germany	36
Shimotomai (1937)	Austria	36
Baksay (1956)	Hungary, Albania, Czechoslovakia	54
Böcher and Larsen (1957); Mulligan (1958)	Portugal	54
Favarger (1959)	Switzerland	54
Czapick (in Skalinska et al., 1961)	Poland	ca. 54
Favarger (1959)	Switzerland	72
Ehrenberg (1945)	Scandinavia	28
Löve and Löve (1956)	Iceland	28
Wulff (1937c)	Germany	28
Jörgensen, et al. (1958)	Greenland	42
Reese (in Löve and Löve, 1961)	Germany	42
Sokolovskaja and Strelkova (1941, 1960)	U.S.S.R.	42
Sokolovskaja (1960)	Sachalin	42
Sokolovskaja-Kulczycka (in Skalinska et al. 1961)	Poland	42
Sokolovskaja and Strelkova (1960)	U.S.S.R.	62–64
Palmgren (1943)	Denmark	14

TABLE II (Cont.)

Species	Coll. no.	Origin	2n
Echinodorus ranunculoides (L.) Engelm. ex Aschers.			
Epipactis helleborine (L.) Crantz	—	near Wageningen (Gelderland)	38
	—	Emmerdennen near Emmen (Drenthe)	38
	—	"Schovenhorst" Putten (Gelderland)	38
	—	idem	38
Euphorbia cyparissias L.	537	St. Jansberg near Mook (Limburg)	20
Filipendula ulmaria (L.) Maxim.	725	Between Jutphaas and IJsselstein (Utrecht)	14 and 16
Galium aparine L.	K 33	near Weerdinge (Drenthe)	66
	K 34	near Weerdinge (Drenthe)	64
	K 17	near Putten (Gelderland)	64
	K 248	Gaasterland, Oude Mirdum (Friesland)	64
	K 435	Westenschouwen (Zeeland)	63
	K 436	Westenschouwen (Zeeland)	63
	K 191	near Putten (Gelderland)	66
Galium hercynicum Weig.	K 252	near Duurswoude (Friesland)	44
	K 364	near Oost-Voorne (S. Holland)	44
	K 386	Eyserbos near Eys (Limburg)	44
	K 414	near Duurswoude (Friesland)	44
Galium palustre L.	K 39	Ravensbos near Valkenburg (Limburg)	24
	K 154	Between Maarn and Maarsbergen (Utrecht)	24
	K 155	idem	24
	K 381	near Monnikendam (N. Holland)	24
Galium pumilum Murr.	K 400	Dolsberg near Wijlre (Limburg)	22

REFERENCES

Author	Origin	2n
Fernandes, Garcia and Fernandes (1948)	Portugal	16
Löve and Löve (1944)	Sweden	16
Packer (in Löve and Löve, 1961)	Ireland	16
Hagerup (1944)	Denmark	18
Weyer (1952)	the Netherlands	40 (20)
Barber (1942)	unknown	38
Skalinska et al. (1957)	Poland	38
Hagerup (1945, 1947)	Denmark	38, 40
Skalinska et al. (1961)	Poland	40
Perry (1943)	U.S.A.	20
Pritchard (1957, 1959)	France	20
Pritchard (1957, 1959); Shimoyama (1959)	cult. mat.	20
Rutland (1941)	England	20
Moore (1958); Moore and Lindsay (1953)	Canada	40
Pritchard (1957, 1959)	Great Britain	40
Wulff (1938)	Germany	14
Maude (1940)	cult. mat.	15
Löve and Löve (1956)	Iceland	16
Polya (1950)	Hungary	16
Tarnavschi (1948)	Romania	16
Turesson (1938)	Siberia, Sweden	16
Piotrowicz (in Skalinska et al., 1959)	Poland	42
Kliphuis (1962)	Portugal, Canada	44
Kliphuis (1962)	Denmark	63
Böcher, Larsen and Rahn (1955)	Spain, France, Denmark, Sweden, Portugal	64
Fagerlind (1934, 1937)	cult. mat.	64
Kliphuis (1962)	Austria, Denmark, France	64
Fagerlind (1934, 1937)	cult. mat.	66
Kliphuis (1962)	Portugal, France, Denmark, England, Sweden	66
Löve and Löve (1956)	Iceland	66
Fagerlind (1934, 1937)	cult. mat.	86, 88
Kliphuis (1962)	Portugal	22
Ehrendorfer (1956)	Germany	44
Fagerlind (1934, 1937)	cult. mat.	44
Kliphuis (1962)	France, Germany	44
Clapham (1949); Hancock (1942)	England	24
Fagerlind (1934, 1937)	cult. mat.	24
Hagerup (1941)	Denmark	24
Kliphuis (1962)	Germany	24
Piotrowicz (in Skalinska et al., 1961)	Poland	24
Clapham (1949)	England	48
Kliphuis (1962)	Portugal	48
Clapman (1949); Hancock (1942)	England	96
Fagerlind (1934)	cult. mat.	96
Kliphuis (1962)	Portugal	96
Kliphuis (1962)	Denmark	44
Piotrowicz (in Skalinska et al., 1959)	Poland	44
Ehrendorfer (1949)	Austria	66

TABLE II (Cont.)

Species	Coll. no.	Origin	2n
Galium pumilum Murr.			
Galium uliginosum L.	K 152	Between Maarn and Maarsbergen (Utrecht)	22
	K 189	Betw. Ermelo and Nw. Millingen (Gelderl.)	22
	K 190	idem	22
	K371/373	near Oost-Voorne (S. Holland)	22
	K 32	Weerdinge near Emmen (Drenthe)	44
	K 153	Between Maarn and Maarsbergen (Utrecht)	44
	K 188	Betw. Ermelo and Nw. Millingen (Gelderl.)	44
Glechoma hederacea L.	353	Fort Hoofddijk near Utrecht (Utrecht)	36
	550	St. Jansberg near Mook (Limburg)	36
	664	Geerendal near Schin op Geul (Limburg)	36
	714	Quackjeswater near Rockanje (S. Holland)	36
Halimione portulacoides (L.) Aellen	815	Boschplaat, Terschelling (Friesland)	36
Hieracium pilosella L.	586	Between Maarn and Maarsbergen (Utrecht)	36
Hippuris vulgaris L.	711	Quackjeswater near Rockanje (S. Holland)	32
Iris pseudacorus L.	320	Rhijnauwen near Bunnik (Utrecht)	34
	336	Molenpolder near Westbroek (Utrecht)	34
Lamium galeobdolon (L.) L.	548	St. Jansberg near Mook (Limburg)	36
	596	Schone Grub near Rijckholt (Limburg)	36
	612	Onderste Bos near Epen (Limburg)	36
Liparis loeselii (L.) Rich.	0 137	near Oost-Voorne (S. Holland)	26

REFERENCES

Author	Origin	2n
Ehrendorfer (1949, 1953)	Austria	88
Ehrendorfer (1955)	the Alps	88
Ehrendorfer (1956)	Germany	88
Goodway (1955, 1957)	England	88
Kliphuis (1962)	Belgium	88
Fagerlind (1934)	cult. mat.	22
Hancock (1942)	England	22
Homeyer (1932)	Germany	22
Fagerlind (1934, 1937)	cult. mat.	44
Löve and Löve (1956)	Iceland	44
Scheerer (1940)	Germany	18
Sugiura (1940)	cult. mat.	18
Suzuka (1950)	acc. to Löve and Löve, 1961	18
Löve and Löve (1942)	Sweden	24
Felföldy (1947); Polya (1949)	Hungary	36
Hara (1954); Hara, Tanaka and Kurusawa (1954)	Japan	36
Löve and Löve (in Löve and Bernard, 1959)	Canada	36
Rutland (1941)	British Isles	36
Skalinska (in Skalinska et al., 1959)	Poland	36
Tarnavschi (1948)	Romania	18
Castro and Fontes (1946)	Portugal	36
Wulff (1937c)	Germany	36
Wulff (1937b)	unknown	36
Turesson and Turesson (1960)	Sweden	36
Christoff and Popoff (1933)	cult. mat.	39, 45
Gentscheff (1937)	cult. mat.	45
Turesson and Turesson (1960)	Sweden	45, 54, 63
Harada (1952)	Japan	30
Jörgensen, Sörensen and Westergaard (1958)	Greenland	32
Löve and Löve (1956)	Iceland	32
Sokolovskaja (1960)	Sachalin	32
Wcislo (in Skalinska et al., 1957)	Poland	24
Polya (1949)	Hungary	24, 30
Heppell (in Maude, 1939)	England	30
Wcislo (in Skalinska et al., 1957)	Poland	32
Ehrenberg (1945)	Sweden	32–34
Felföldy (1947); Polya (1949)	Hungary	34
Fernandes, Garcia and Fernandes (1948)	Portugal	34
Linder and Brun (1956); Simonet (1928)	France	34
Mori (1957)	Italy	34
Wcislo (in Skalinska et al., 1947)	Poland	34
Polya (1949)	Hungary	18
Turesson (1938)	Sweden	18
Turesson (1938)	U.S.S.R. (Latvia)	18
Turesson (1938)	Germany	36
Hagerup (1941)	Denmark	32

TABLE II (Cont.)

Species	Coll. no.	Origin	2n
Listera cordata (L.) R.Br.	—	Schiermonnikoog (Friesland)	40
Listera ovata (L.) R.Br.	0 205	Eyserbos near Eys (Limburg)	35
	0 311	near Oost-Voorne (S. Holland)	34, 35, 36 37, 38
	0 312	near Oost-Voorne (S. Holland)	34, 35, 38
	0 110	Allemanskamp near Veenendaal (Utrecht)	35
	0 257	Osebos near Gulpen (Limburg)	34
	0 111	Allemanskamp near Veenendaal (Utrecht)	36
	0 313	near Oost-Voorne (S. Holland)	34
Lonicera periclymenum L.	534	St. Jansberg near Mook (Limburg)	54
	623	near Vijlen (Limburg)	54
	715	Quackjeswater near Rockanje (S. Holland)	54
Lysimachia nemorum L.	666	Bunderbos near Bunde (Limburg)	16
Lysimachia nummularia L.	591	Rhijnauwen near Bunnik (Utrecht)	43
	633	Bemelen (Limburg)	32
	713	Quackjeswater near Rockanje (S. Holland)	43
	805	Fort Hoofddijk near Utrecht (Utrecht)	32
Lysimachia vulgaris L.	709	Quackjeswater near Rockanje (S. Holland)	56
Mercurialis perennis L.	361 ♂	Schweibergerbos near Mechelen (Limburg)	66
	362 ♀	idem	64
Myosotis sylvatica Ehrh. ex Hoffm.	355	Schweiberger Bos near Mechelen (Limburg)	18
Origanum vulgare L.	638	Bemelerberg near Bemelen (Limburg)	30
Ornithogalum umbellatum L.	—	Beuningen near Denekamp (Overijssel)	27

REFERENCES

Author	Origin	2n
Löve and Löve (1956)	Iceland	36, 38
Banach-Pogan and Wcislo (in Skal. et al., 1961)	Poland	38
Sokolovskaja (1960)		
Sokolovskaja and Strelkova (1940)	U.S.S.R.	38
Tuschnjakova (1929)	U.S.S.R.	32, 34, 36
Barber (1942)	unknown	34
Hoffmann (1929, 1930)	Germany	34
Skalinska et al., (1957)	Poland	34
Staner (1929)	unknown	34
Hagerup (1947)	Denmark	34, 36
Löve and Löve (1944)	Sweden	34, 36, 38
MacMahon (1936)	Belgium	34, 35, 36 37, 38
Richardson (1933)	England	34, 35, 36
Janaki Ammal and Saunders (1952)	unknown	18
Rutland (1941)	Great Britain	18
Hagerup (1941)	Denmark	ca. 36
Janaki Ammal and Saunders (1952)	England	36
idem	unknown	36
Poucques (1948, 1949)	France	36
Wulff (1938)	Germany	18
Levitsky in litt. (in Tischler, 1950)	unknown	34–36
Wulff (1938)	Germany	36
Levitsky in litt. (in Tischler, 1937)	unknown	28
Baksay (1957)	Hungary	42
Britton (1951)	cult. mat.; Greece	18
Geitler (1936); Griesinger (1937)	Austria	18
Löve and Löve (1956)	Iceland	18
Geitler (1936); Griesinger (1937); Mattick (in Tischler, 1950)	Austria	24
Geitler (1936); Griesinger (1937)	Austria	32
Larsen (1960)	Can. Islands	30
Rutland (1941)	British Isles	30
Scheerer (1940)	Germany	32
de Barros Neves (1952, 1956)	Portugal; cult. mat.	18
idem	Portugal	18–27
Czapick (in Skalinska et al., 1961)	Poland	27
Nakajima (1936); Rodriguez (1953); Sprumont (1928)	unknown	27
de Barros Neves (1952)	Portugal; cult. mat.	27
Polya (1950)	Hungary	27
Sato (1942)	cult. mat.	27
de Barros Neves (1952)	cult. mat.	36
de Barros Neves (1952); Sprumont (1928)	cult. mat.	45
de Barros Neves (1952); Matsuura and Suto (1935)	cult. mat.	54

TABLE II (Cont.)

Species	Coll. no.	Origin	2n
Ornithogalum umbellatum L.			
Parnassia palustris L.	799	Betw. Ermelo and Nw. Millingen (Gelderl.)	36
Poa nemoralis L.	366	Schweiberger Bos near Mechelen (Limburg)	42
	535	St. Jansberg near Mook (Limburg)	42
Polygonatum multiflorum (L.) All.	554	St. Jansberg near Mook (Limburg)	18
	601	Schone Grub near Rijckholt (Limburg)	18
	631	Schweiberger Bos near Mechelen (Limb.)	18
Polygonatum odoratum (Mill.) Druce	708	Quackjeswater near Rockanje (S. Holland)	20
Potentilla anserina L.	527	Between Houten and Schalkwijk (Utrecht)	42
	813	Boschplaat, Terschelling (Friesland)	28

REFERENCES

Author	Origin	2n
de Barros Neves (1956)	Portugal, France	54
idem	cult. mat.	72
Banach-Pogan (1956)	Poland	18
Erlandsson (1942)	Sweden, Denmark	18
Hamel (1953)	France	18
Matsuura and Suto (1935)	Japan	18
Quezel (1957)	North Africa	18
Rozanova (1940); Sokolovskaja and Strelkova (1960)	U.S.S.R.	18
Erlandsson (1942); Löve and Löve (1944)	Sweden	36
Hedberg (1958)	Scotland	36
A. Löve (1950); Löve and Löve (1951, 1956)	Iceland	36
A. Löve (1950)	Canada	36
Avdulov (1928, 1931)	cult. mat.	28
Skalinska (in Skalinska et al., 1961)	Poland	28
Sokolovskaja and Strelkova (1940)	Acc. to Löve and Löve, 1961	28
Kiellander (in Löve and Löve, 1942)	Scandinavia	28–38, 43
Guinochet (1943)	France	33
Tateoka (1956)	cult. mat.	35
Armstrong (1937)	England	42
Guinochet (1943)	France	42
Hooper (in Löve and Löve, 1961)	England, Scotland, The Netherl.	42
Jörgensen, Sörensen and Westergaard (1958)	Geenland	42
Kiellander (in Löve and Löve 1942)	Scandinavia	42
Löve and Löve (1948, 1956)	Iceland	42
Stählin (1929)	unknown	42
Hooper (in Löve and Löve, 1961)	Scotland	56
van Berg (1933)	cult. mat.	18
Dark (in Maude, 1939)	England	18
Junell (in Löve and Löve, 1942)	Scandinavia	18
Polya (1950)	Hungary	18
Suomalainen (1947)	Sweden, Finland	18
Therman (1953)	acc. to Löve and Löve, 1961	18
Suomalainen (1947)	cult. mat.	20
Therman-Suomalainen (1949)	acc. to Löve and Löve, 1961	20
Dark (in Maude, 1939)	England	30
van Berg (1933)	cult. mat.	20
Fernandes (1950)	Portugal	20
Junell (in Löve and Löve, 1942)	Scandinavia	20
Hasegawa (1933)	unknown	20
Mori (1957)	Italy	20
Suomalainen (1947)	Sweden, Finland, Denmark	20
Therman (1953)	acc. to Löve and Löve, 1961	20
Therman-Suomalainen (1949)	idem	26, 28, 30
Maude (1939)	England	26, 28, 30
Löve and Löve (1942)	Sweden	28
Löve and Löve (1956)	Iceland	28
Polya (1949)	Hungary	28
Popoff (1935)	cult. mat.	28
Skalinska and Czapick (1959)	Poland	28
Turesson (1938)	North America, Sweden	28
Erlandsson (1942)	Sweden, Denmark	42

TABLE II (Cont.)

Species	Coll. no.	Origin	2n
Potentilla anserina L.			
Prunella vulgaris L.	802	Betw. Ermelo and Nw. Millingen (Gelderl.)	28
Ranunculus acris L.	335	Molenpolder near Westbroek (Utrecht)	14
	339	idem	14
	524	Between Houten and Schalkwijk (Utrecht)	14
	560	Fort Hoofddijk near Utrecht (Utrecht)	14
	584	near Maarn (Utrecht)	14
	817	near Oosterend, Terschelling (Friesland)	14
Ranunculus auricomus L.	2	near Gorkum (S. Holland)	32
	7	Lohmanskamp near Ootmarsum (Overijss.)	32
	14	Between Boxtel and Best (N. Brabant)	32
	19	Camerig near Epen (Limb.)	32
	20	Eyserbos, Eys (Limburg)	32
	23	Rhijnauwen near Bunnik (Utrecht)	32
	25	near Epen (Limburg)	32
	40	Between Terziet and Epen (Limburg)	32
	49	near Mechelen (Limburg)	32
	55	Biesbos (N. Brabant)	32
	206	near Hardenberg (Overijssel)	32
Ranunculus repens L.	359	Between Gulpen and Slenaken (Limburg)	32
	526	Between Houten and Schalkwijk (Utrecht)	32
	542	St. Jansberg near Mook (Limburg)	32
	559	Fort Hoofddijk near Utrecht (Utrecht)	32
	583	near Maarn (Utrecht)	32
	594	Mereveld near Utrecht (Utrecht)	32
	607	Schone Grub near Rijckholt (Limburg)	32
	628	Schweiberger Bos near Mechelen (Limburg)	32
	692	Grebbeberg, Rhenen (Utrecht)	32
	710	Quackjeswater near Rockanje (S. Holland)	32
	752	Betw. Ermelo and Nw. Millingen (Gelderl.)	32
Rhynchospora alba (L.) Vahl	741	Betw. Ermelo and Nw. Millingen (Gelderl.)	26

REFERENCES

Author	Origin	2n
Roscoe (1927)	North America	42
Böcher (1949)	Faroes, Denmark, Sweden, U.S.S.R. Austria, France, Portugal, Canada	28
Levitsky (1940)	unknown	28
Löve and Löve (1956)	Iceland	28
Böcher (1940)	Norway, Denmark, Canada, Faroes	32
Hara (1954)	Japan	32
Hruby (1932)	Central Europe	32
Mattick (in Tischler, 1950)	Austria	32
Sorokin (1924, 1927, a-b-c-d-)	cult. mat.	12–18
Croonen (1939)	cult. mat.	14
Hara and Kurosawa (1956)	Japan	14
Hess (1953)	Switzerland	14
Kurita (1956, 1957, 1958)	acc. to Löve and Löve (1961)	14
Langlet (1932)	Sweden	14
Larter (1932); Miyaji (1927)	unknown	14
Löve and Löve (1944)	Sweden	14
Löve and Löve (1956)	Iceland	14
Marsden Jones and Turrill (1935)	England	14
Matsuura and Suto (1935)	Japan	14
Mulligan (1959)	Canada	14
Polya (1950)	Hungary	14
Tomaszewski (1959)	Poland	14
Hara and Kurosawa (1956)	Japan	28
Langlet (1932)	Germany	28
Senjaninova (1926)	U.S.S.R.	28, 29–32
Nygren (in Löve and Löve, 1948)	Scandinavia	28, 56
Häfliger (1943); Rutishauser (1954)	Switzerland	32
Kleczkowska (in Skalinska et al., 1961)	Poland	32
Langlet (1932); Larter (1932)	cult. mat.	32
Levitsky (1940)	acc. to Löve and Löve, 1961	32
Löve and Löve (1956)	Iceland	32
Mattick (in Tischler, 1950)	Austria	32
de Barros Neves (1944)	Portugal	32
Polya (1950)	Hungary	32
Rousi (1956)	Finland	32
Häfliger (1943)	Switzerland	40, 48
Rousi (1956)	Finland	40, 48
Matsuura and Suto (1935)	Japan	16
Mattick (in Tischler, 1950)	Austria	16
Hocquette (1922); Langlet (1927); Larter (1932)	unknown	32
Kurita (1958)	acc. to Löve and Löve, 1961	32
Löve and Löve (1956)	Iceland	32
Matsuura and Suto (1935)	cult. mat.	32
Mattick (in Tischler, 1950)	Austria	32
de Barros Neves (1950)	Portugal	32
Polya (1949)	Hungary	32
Sokolovskaja (1960)	Sachalin	32
Sokolovskaja and Strelkova (1930)	U.S.S.R.	32
Scheerer (1940)	Germany	26
Löve and Löve (1942)	Sweden	42

TABLE II (Cont.)

Species	Coll. no.	Origin	2n
Rorippa amphibia (L.) Besser	322	Rhijnauwen near Bunnik (Utrecht)	32
Symphytum officinale L.	319	Rhijnauwen near Bunnik (Utrecht)	48
	338	Molenpolder near Westbroek (Utrecht)	40
	530	near IJsselstein (Utrecht)	26
	531	Betw. Jutphaas and IJsselstein (Utrecht)	48
	532	idem	40
	558	Fort Hoofddijk near Utrecht (Utrecht)	48
Teucrium scorodonia L.	367	Schweiberger Bos near Mechelen (Limb.)	32
	539	St. Jansberg near Mook (Limburg)	32
	614	Vijlen (Limburg)	32
	693	Grebbeberg, Rhenen (Utrecht)	32
Trifolium dubium Sibth.	K 98	Walcheren near Middelburg (Zeeland)	28
Trifolium ornithopodioides L.	K 91	Isle of Walcheren, (Zeeland)	16
Trifolium scabrum L.	K 92	West-Kapelle, Walcheren (Zeeland)	10
	K 121	idem	10
	—	idem (14 ×)	10
	—	Renesse (Schouwen), Zeeland	10
Trifolium subterraneum L.	K 96	West-Kapelle, Walcheren (Zeeland)	16
Urtica dioica L.	536	St. Jansberg near Mook (Limburg)	48
	321	Rhijnauwen near Bunnik (Utrecht)	52
	582	Maarn (Utrecht)	52
	595	Schone Grub near Rijckholt (Limburg)	52
	686	Grebbeberg near Rhenen (Utrecht)	52
	729	near Utrecht (Utrecht)	52
Urtica urens L.	705	in a garden, Utrecht (Utrecht)	24
Valeriana officinalis L. (s.l.)	626	Schweiberger Bos near Mechelen (Limb.)	56
	662	Geerendal, Schin op Geul (Limburg)	56
	669	Between Baarn and Eemdijk (Utrecht)	56
	707	Quackjeswater, Rockanje (S. Holland)	56
	721	near IJsselstein (Utrecht)	56

REFERENCES

Author	Origin	2n
Howard (1953)	British Isles	16
Howard (1953)	British Isles	32
Löve and Löve (1942)	Scandinavia	32
Wulff (1936b)	Germany	32
Strey (1931)	cult. mat.	ca. 36
Suzuka (1950)	acc. to Löve and Löve, 1961	36
Löve and Löve (1956)	Iceland	ca. 40
Datta (1933)	cult. mat.	42
Tarnavschi (1948)	Romania	48
Mori (1957)	Italy	32
Scheerer (1940)	Germany	32
Rutland (1941)	British Isles	34
Bleier (1925)	Germany	28
Kliphuis (1962)	the Netherlands	28
Wipf (1939)	U.S.A.	28
Wexelsen (1928)	U.S.A.	32
Kliphuis (1962)	the Netherlands	16
Rutland (1941)	England	18
Larsen (1960)	Italy, Yugoslavia, Can. Isles	10
Leffers, 1962 (unpubl.)	the Netherl., Portugal, Spain, Italy	10
Kliphuis (1962)	the Netherlands	10
Karpechenko (1925)	unknown	16
Rodrigues (1953)	unknown	16
Yates and Brittan (1952); Brock (1952)	Israel	12
Brock (1953)	England, Marocco, Malta, Portugal	16
Hutton and Peak (1954); Morley, Brock and Davern (1956)	Australia	16
Kliphuis (1962)	the Netherlands	16
Wexelsen (1928)	U.S.A.	16
Heitz (1926)	unknown	48
Löve and Löve (1942)	Sweden	48
Löve and Löve (1956)	Iceland	48
Meurman (1925)	Denmark	48
Fothergill (1936)	England	52
Fothergill (1936)	England	24
Löve and Löve (1942)	Sweden	24, 26
Löve and Löve (1948, 1956)	Iceland	24
Meurman (1925)	Denmark	24
Polya (1949)	Hungary	24
Löve and Löve (1942)	Sweden	52
Blackburn (1936); Protassenja (1930)	acc. to Löve and Löve, 1961	14
Cervenka (1955)	Czecho-Slovakia	14
Poucques (1948, 1949)	France	14
Sarkany and Baranyai (1958)	Hungary	14
Senjaninova (1927)	U.S.S.R.	14

TABLE II (Cont.)

Species	Coll. no.	Origin	2n
Valeriana officinalis L. (s.l.)			
Veronica officinalis L.	368	Schweiberger Bos near Mechelen (Limb.)	34
	698	Grebbeberg near Rhenen (Utrecht)	32
Vicia cracca L.	345	Molenpolder near Westbroek (Utrecht)	28
Viola riviniana Rchb.	—	21 different localities in the Netherlands	40
	50	Schweiberger Bos near Mechelen (Limb.)	35
	165	Geerendal, Schin op Geul (Limburg)	35
	198	Savelsbos near Rijckholt (Limburg)	35
	217	Putten, Schovenhorst (Gelderland)	45
	39	Epen, Bovenste Bos (Limburg)	45
	131	near Oldenzaal (Overijssel)	46
	17	Ravenbos near Valkenburg (Limburg)	46
	297	near Chaam (N. Brabant)	47
	180	near Sleen (Drenthe)	47
Viola palustris L.	132	near Denekamp (Overijssel)	48

REFERENCES

Author	Origin	2n
Skalinska (1950)	Poland	14
Walther (1949)	Germany	14
Blackburn (1936); Protassenja (1930)	acc. to Löve and Löve, 1961	28
Polya (1949); Sarkany and Baranyai (1958)	Hungary	28
Senjaninova (1927)	U.S.S.R.	28
Skalinska (1945, 1947)	England	28
Skalinska (1950)	Poland	28
Walther (1949)	Germany	28
Cervenka (1955)	Czecho Slovakia	56
Hegnauer and Meyers (1958)	the Netherlands	56
Löve and Löve (1956)	Iceland	56
Meurman (1925)	Denmark	56
Sarkany and Baranyai (1958)	Hungary	56
Skalinska (1945, 1947); Todd (1942)	England	56
Skalinska (in Skalinska et al., 1959)	Poland	56
Böcher (1944)	Sweden	18
Huber (1927)	cult. mat.	32–37
Afanasiyeva and Meshkova (1961)	unknown	34
Simonet (1934)	France	34, 36
Böcher (1944)	Faroes, Iceland, Denmark, Norway, Germany, Finland, Sweden	36
Löve and Löve (1956)	Iceland	36
Renkonen and Therman (1952); Rousi (1961)	cult. mat.	12
Sakamura (1914)	Japan	12
Sveshnikova (1927)	U.S.S.R.	12
Baksay (1954)	Hungary	14
Rousi (1961)	France, Austria, Hungary, U.S.S.R.	14
Ryka (1954)	Poland	14
Senn (1938); Moriya and Kondo (1950)	unknown	14
Renkonen and Therman (1952)	cult. mat.	27, 28
Rousi (1961)	cult. mat.	27
Jörgensen, et al. (1958)	Greenland	28
Ledingham (1957)	Canada	28
Löve and Löve (1944)	Sweden	28
Löve and Löve (1956)	Iceland	28
Rousi (1961)	Finland, Sweden, Denmark, England, the Netherlands, Germany, Poland, France, Austria, Switzerland, U.S.S.R., Canada, New Zeal.	28
Ryka (1954)	Poland	28
Sveshnikova (1927)	U.S.S.R., Germany	28
Clausen (1927); Gershoy (1934)	Denmark	40
Fothergill (1944); Valentine (1941, 1949, 1950)	England	40
Gadella (1963, in press)	Germany, Belgium	40
Schmidt (1961); Schöfer (1954)	Germany	40
Gadella (1963, in press)	the Netherlands	35, 40, 45 46, 47
Valentine (1949)	England	45, 46, 47
Quezel (1957)	North Africa	24

TABLE II (Cont.)

Species	Coll. no.	Origin	2n
Viola palustris L.	248	Betw. Ermelo and Nw. Millingen (Gelderl.)	48
	83	near Maarn (Utrecht)	48

TABLE III

Species with chromosome numbers not determined before.

coll. no.	species	origin	2n
667	Lysimachia thyrsiflora L.	between Baarn and Eemdijk, Utrecht.	54
720	Scutellaria galericulata L.	near IJsselstein, Utrecht.	30
528	Scrophularia neesii Wirtg.	near IJsselstein, Utrecht.	52
613	Scrophularia balbisii Hornem.	near Epen, Terziet, Limburg	78

DISCUSSION

A. *Species with chromosome numbers in accordance with the literature:*

1. **Thymus pulegioides** L.

Previously *Thymus pulegioides* L. and *Thymus serpyllum* L. (s. str.) were considered as subspecies of *Thymus serpyllum* L. (s.l.), named: *Thymus serpyllum* L. ssp. *chamaedrys* (Fr.) Vollm. and *Th. serpyllum* L. ssp. *angustifolium* (Pers.) Vollm. respectively.

The first is a plant of calcareous soil, the latter of diluvial sand. The subspecies have different chromosome numbers, ssp. *angustifolium*: 2n = 24, and ssp. *chamaedrys*: 2n = 28. Besides morphological and ecological differences, cytological evidences also supports the splitting into two species.

2. **Armeria maritima** (Mill.) Willd.

Besides plants from the Dutch coast, also plants from Belgium were investigated. The origin of the Belgian plants was a typical *Violetum-Calaminariae* on rubble of a zinc mine, near La Calamine. The chromosome number 2n = 18 could be determined for all nine investigated plants.

B. *Species with intraspecific cytological variation.*

This group can be divided as follows:

1. **Species with an intraspecific aneuploid series.**
2. **Species with an intraspecific euploid series.**
3. **Species with both intraspecific euploidy and aneuploidy.**

REFERENCES

Author	Origin	2n
Bold and Gershoy (1934)	Canada	48
Clausen (1931)	Denmark	48
Fernandes (1950)	Portugal	48
Gadella (1963, in press)	the Netherlands, Belgium	48
Gershoy (1928)	North America	48
Jörgensen, et al., (1958)	Greenland	48
Löve and Löve (1956)	Iceland	48

The distinguished groups will be described successively.

1. **Species with an intraspecific aneuploid series.**

To this group belong the following investigated species: *Aethusa cynapium* L.; *Alisma plantago-aquatica* L.; *Artemisia vulgaris* L.; *Baldellia ranunculoides* (L.) Parl.; *Epipactis helleborine* (L.) Crantz.; *Filipendula ulmaria* (L.) Maxim.; *Hippuris vulgaris* L.; *Liparis loeselii* (L.) Rich.; *Listera cordata* (L.) R.Br.; *Listera ovata* (L.) R.Br.; *Lysimachia nemorum* L.; *Lysimachia nummularia* L.; *Mercurialis perennis* L.; *Myosotis sylvatica* Ehr. ex Hoffm.; *Origanum vulgare* L.; *Rhynchospora alba* (L.) Vahl.; *Teucrium scorodonia* L.; *Trifolium dubium* Sibth.; *Trifolium ornithopodioides* L.; *Trifolium scabrum* L.; *Trifolium subterraneum* L.; *Urtica dioica* L.; *Viola riviniana* Rchb.

From the above mentioned species the following will be discussed further:

1. **Artemisia vulgaris** L.

A number of species of the genus *Artemisia* have the basic number $x = 8$ and $x = 9$. *Artemisia vulgaris* belongs either to both groups or the material from India may belong to another species.

2. **Filipendula ulmaria** (L.) Maxim.

In the same roottip metaphaseplates with $2n = 14$ and $2n = 16$ were found. These chromosome numbers were known before. But they were always referred to separate plants and are not known to occur within the same individual.

The chromosome number $2n = 15$, mentioned in the literature might possibly indicate an hybridisation between plants with $2n = 14$, and plants with $2n = 16$.

3. **Listera ovata** (L.) R. Br.

The chromosome numbers $2n = 34$, 35, 36 and 37 were determined. The numbers 35, 36 and 37 are caused by respectively one, two or three small additional chromosomes, not present in the 34 individuals.

Morphological differences between plants with different chromosome numbers are not present. Apparently the extra chromosomes have to be considered as supernumeraries as suggested by MacMahon

in his study of the behaviour of these additional chromosomes during meiosis. (1936).

4. **Lysimachia nummularia** L.

For this species the chromosome number 2n = 36 is mentioned in the literature; meanwhile *Lysimachia nemorum* L. has the number 2n = 18.

This might suggest a basic number x = 9, at least for a part of this genus.

The determined chromosome number in our investigations, appeared to be 2n = 32 and 2n = 16, indicating a basic number x = 8.

In plants of *Lysimacha nummularia* from two different localities the chromosome number 2n = 43 was counted.

5. **Mercurialis perennis** L.

In Hungary BAKSAY (1957) found the chromosome number 2n = 42 in two plants of this species. According to this author, the material investigated by MEURMAN (1925) having the chromosome number 2n = 64, belongs to *Mercurialis longistipes* (Borbas) Baks., which also occurs in Hungary. Baksay examined eight plants and found 2n = 64.

In the Netherlands *Mercurialis perennis* L. appeared to have 2n = 64 in female plants and 2n = 66 in male plants.

Further research concerning the constancy of the difference between the chromosome numbers of the male- and the female plants in different populations in the Netherlands is planned.

The results of our investigation concerning the female plants having the chromosome number 2n = 64 might indicate that the opinion of Baksay with regards to the investigations of Meurman is incorrect.

6. **Trifolium scabrum** L.

This species is rare in the Netherlands. Plants from the province of Zeeland (Walcheren and Schouwen), were collected and investigated. They all had the diploid number 2n = 10 (KLIPHUIS 1962, LEFFERS, unpubl.). Leffers also counted 2n = 10 in material from Portugal, Spain and Italy.

7. **Trifolium subterraneum** L.

The chromosome number in this species is 2n = 16.

In plants from Israël BROCK (1953) found 2n = 12. This author suggested that the difference in chromosome number might be the result of a rearrangement of the chromosomes without loss of material.

8. **Viola riviniana** Rchb.

Extensive experimental research on this species growing in the Netherlands has been done by GADELLA (1963). The material investigated so far, seems to be more like that from Britain than that from southern Germany, because in different populations extra chromosomes appeared to be present without any correlation with morphological characters. Morphological the species *Viola riviniana*

Rchb. is closely related to the diploid species *Viola reichenbachiana* Jord. ex Bor., but several diagnostic characters permit an easy distinction between the two species at least in the Netherlands.

In 1962, in the south of the province of Limburg, some obviously intermediate plants were collected. These plants are subjected to further investigations in Utrecht.

2. Species with an intraspecific euploid series.

The following investigated species belong to this group: *Actaea spicata* L.; *Alliaria petiolata* (Bieb.) Cavara et Grande; *Butomus umbellatus* L.; *Campanula rotundifolia* L.; *Cardamine amara* L.; *Chrysanthemum leucanthemum* L.; *Comarum palustre* L.; *Euphorbia cyparissias* L.; *Galium hercynicum* Weig.; *Galium palustre* L.; *Galium uliginosum* L.; *Glechoma hederacea* L.; *Halimione portulacoides* (L.) Aellen.; *Hieracium pilosella* L.; *Lamium galeobdolon* (L.) L.; *Lonicera periclymenum* L.; *Lysimachia vulgaris* L.; *Ornithogalum umbellatum* L.; *Parnassia palustris* L.; *Potentilla anserina* L.; *Prunella vulgaris* L.; *Ranunculus auricomus* L.; *Ranunculus repens* L.; *Rorippa amphibia* (L.) Bessu.; *Valeriana officinalis* L.; *Viola palustris* L.

Next species will be discussed further:

1. Butomus umbellatus L.

According to A. Löve (1951), in Sweden the triploid (2n = 39) races can be distinguished from the diploid ones (2n = 26) morphologically, owing to their sterility and high degree of bulbifery. Whether this is also correct for other parts of the area, in particular in the Netherlands, can only be proved by further investigations.

2. Campanula rotundifolia L. (s.l.)

A survey of cytological data concerning this species up to the present was given by Gadella (1962).

Crossings between diploids, tetraploids and hexaploids are the subject of further research by this author.

3. Chrysanthemum leucanthemum L. (s.l.)

According to Böcher and Larsen (1957) the diploid races of this complex species belong to *Chrysanthemum leucanthemum* L. (s. str.) and the tetraploid ones to *Chrysanthemum ircutianum* Turcz. (s.l.), although some diploid varieties show some morphological resemblance to the tetraploids. The material examined by us proved to be tetraploid. Diploid plants have not been found in the Netherlands yet.

4. Euphorbia cyparissias L.

Tetraploids (2n = 40) and sterile diploids (2n = 20) are found in Canada. Tetraploids are also common in England, the sterile diploids escaped there from gardens occasionally. On the continent of Europe tetraploids should be more numerous than diploids. However, Pritchard (1959), found a fertile diploid plant in a wood near Fontainebleau.

MOORE and LINDSAY (1953) gave a diameter of 22–26 micron for the sterile and empty pollen of the diploids and one of 35–40 micron for the fertile pollen of the tetraploids. The plants investigated by us were diploid. The pollen appeared to be normal, with a diameter of 32–37 micron so that these may be regarded as fertile.

5. **Galium palustre** L.

Only plants with 2n = 24 were found in the Netherlands. (KLIPHUIS, 1962). The chromosome numbers 2n = 48 and 2n = 96 are known from other countries. According to CLAPHAM (1949) the diploids and octoploids can be separated morphologically. The tetraploids, however, are intermediate. For that reason this author suggested that the three forms should be treated as cytological subspecies rather than separate species.

6. **Glechoma hederacea** L.

In Hegi's "Flora von Mitteleuropa" (1906/1931), the species *Glechoma hederacea* L. is divided into two subspecies: ssp. *glabriusculum* (Neilr.) Gams, (= *Glechoma hederacea* L. s. str.) and ssp. *hirsutum* (W. et K.) Hermann, (= *Glechoma hirsuta* W. et K.). According to D. LÖVE and J. P. BERNARD (1959) the diploid *Glechoma hederacea* L. s. str., with 2n = 18 is unknown in Canada, only the tetraploid large flowering and pubescent form is found there.

In the Netherlands the chromosome number 2n = 36 could be determined in four cases.

Table four gives a survey of the differential characters of the two subspecies according to Hegi and the characters of the plants investigated cytologically by us.

The Dutch material appears to have many characters of the subspecies *glabriusculum*, except that it is not diploid but tetraploid.

An extensive cytotaxonomic study may give more clarity about the taxonomic significance of the diploid and tetraploid races.

7. **Hieracium pilosella** L.

In Sweden this species was investigated extensively by TURESSON and TURESSON (1960). Plants with 2n = 36 appeared to be amphimictic, the plants with 2n = 45, or more chromosomes, amphiapomictic.

All plants investigated by us had the chromosome number 2n = 36; according to the results of Turesson and Turesson these plants are possibly amphimictic too.

8. **Lamium galeobdolon** L.

According to TURESSON (1938) this species is characterized by: "a diploid type being distributed in the north and a taller, late flowering, more robust, tetraploid southern type. The tetraploid is sometimes treated as a variety, or even as a separate species: *Galeobdolon montanum* Rchb."

The material investigated by us appeared to be tetraploid.

TABLE IV

A comparison of the morphological and cytological characters of the two subspecies of Glechoma hederacea L.

	population number			
	353	550	664	714
subsp. glabriusculum (Neilr.) Gams.	x	x	x	x
1a. stem and leaves with scattered patent-retrorse hairs.	x	x	x	x
2a. petioles shorter than internodes	x	x	x	x
3a. width of leafs up to 3 cm.	x	x	x	–
4a. corolla violet-blue, up to 3 cm. long.				
5a. posterior stamens of the corolla much shorter than the upper lip of the corolla.	x	x	x	–
6a. calyx teeth triangular, $^1/_3$ × calyx tube, aristated.	x	x	x	x
7a. throughout the area of the species.				
8a. chromos. number: 2n = 18 (D. Löve, 1959)				
subsp. hirsutum (W. et K.) Herm.				
1b. stem indumentum pilose to appressed scabrous-hirsute.				
2b. petiole equalling the internode.				
3b. width of leafs 3–4 cm. long (up to 7 cm.)				
4b. corolla bright blue, up to 3 cm. long.				
5b. posterior stamens attaining sinus of upper lip.	x	x	x	–
6b. calyx teeth narrowly lanceolate with a long slender, often violet arista.				
7b. S. and S.E. Europe.				
8b. chromos. number: 2n = 36 (D. Löve, 1959)	x	x	x	x

9. **Lonicera periclymenum** L.

Up to the present only a few hexaploid *Lonicera* species are known, all from southeast Asia. (JANAKI-AMMAL and SAUNDERS, 1939). The European plants, as far as investigated, are diploid or tetraploid.

All the material examined by the present authors turned out to be hexaploid.

10. **Parnassia palustris** L.

According to A. LÖVE (1950) the tetraploid plants of this species, with the chromosome number 2n = 36, have a circumpolar distribution, the diploids, with 2n = 18 an eurasiatic. This is confirmed by ROZANOVA (1940, 1946) and BANACH-POGAN (1956).

The diploids and tetraploids can be separated morphologically. In contradiction to what could have been expected, tetraploid plants of *Parnassia palustris* L. were found in the Netherlands only.

For a final conclusion it is desirable to undertake a more detailed study of material present in the Netherlands to ascertain wether *Parnassia palustris* L. is mainly occuring as a tetraploid or as a diploid.

11. **Valeriana officinalis** L. (s.l.)

Sometimes this collective species is split into four species: *Valeriana officinalis* L. (s. str.), with 2n = 14; *Valeriana collina* Wallr., with 2n = 28; *Valeriana procurrens* Wallr., with 2n = 56 and *Valeriana sambucifolia* Mikan, with 2n = 56.

These four species can be distinguished very well morphologically, but in some parts of the area the situation is troubled by hybridisation.

In the Netherlands HEGMANN and MEYERS (1958), found octoploids only. This could be confirmed by our investigations. Hegmann and Meyers do not underscribe the splitting as mentioned above. WALTHER (1949), gives a distribution map of the European species. According to her the octoploid *Valeriana procurrens* Wallr. (2n = 56) occurs in the Netherlands only.

3. Species with both intraspecific euploidy and aneuploidy.

Galium aparine L.; *Iris pseudacorus* L.; *Poa nemoralis* L.; *Polygonatum multiflorum* (L.) All.; *Polygonatum odoratum* (Mill.) Druce; *Ranunculus acris* L.; *Symphytum officinale* L.; *Urtica urens* L.; *Veronica officinalis* L.; *Vicia cracca* L.

Next species will be discussed further:

1. **Galium aparine** L.

Plants with the chromosome number 2n = 64 seem to be most common, but this species occurs also as a di-, tetra-, hexa- and octoploid, with 2n = 22, 44, 66 and 88 respectively.

In the metaphaseplates of cells of 2n = 64, two large chromosomes are present. BÖCHER *et al.* (1955), suggested that each of these two large chromosomes may have arisen by fusion of two short chromosomes.

2. **Symphytum officinale** L.

Three cytotypes of this species, with 2n = 26, 40 and 48 respectively, were found in a limited area. Morphological and ecological differences are not known.

Investigations to this extend will be undertaken in the future. In addition the possibility of crossings between the cytotypes will be the subject of research.

C. *Species with chromosome numbers not determined before.*

1. **Lysimachia thyrsiflora** L.

DAHLGREN (1916) did not succeed to establish the exact chromosome number of this species (2n = ca. 40).

The chromosome number of the plants investigated by us could be determined without doubt as 2n = 54.

2. **Scutellaria galericulata** L.

Up to now this species was investigated only once. However, the chromosome number could not be determined exactly (2n = ca. 32).

In the somatic metaphaseplates of roottip cells of plants studied by us the number 2n = 30 was counted repeatedly.

3. **Scrophularia neesii** Wirtg. and **Scrophularia balbisii** Hornem.

The first species mentioned has a chromosome number of 2n = 52, the second 2n = 78.

Both species are also considered as two subspecies of *Scrophularia alata* L. The cytological data, however, indicate that most likely these taxa are separate species. Further research in order to ascertain if there is a genetic barriere between the two species present, is planned.

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